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THE INSECT COLLECTION OF THE ROYAL ONTARIO MUSEUM OF ZOOLOGY.

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The insect collection of the Royal Ontario Museum of Zoology, at present comprising some 250,000 specimens, had its inception in the insect collection of the University of Toronto Biological Museum. This collection was started by Professor William Hincks, first Professor of Natural History, when he established a natural history museum in 1853. At that time various collections of insects, mostly confined to exotic material, were donated or purchased.

Under Professor Ramsay Wright, who was head of the Department of Biology from 1874 to 1912, the Biological Museum developed into an institution of considerable importance. The earliest record we have of this period is an invoice dated February 6th, 1906, showing the purchase of a collection of North American insects illustrating mimicry and protective coloration. Other material was purchased to illustrate life histories of various species and a number of specimens were received from South America and Africa. Mr. Edmund M. Morris gave a miscellaneous collection of a few hundred specimens from the Muskoka district about 1906 and a collection of Nova Scotia Lepidoptera was purchased from Mr. J. Russell a little later. A list of the specimens in the Biological Museum in April, 1909 includes 8,240 insects. Some of these may be viewed in our gallery at the present time, and they still remain a source of information and pleasure to the museum visitor.

From the time he joined the staff of the Department of Biology in 1906, Professor E. M. Walker directed the development of the entomological collections and a good deal of the material, especially in Orthoptera and Odonata, is of Professor Walker's collecting. It was during the earlier years of this period (1906-1916) that Mr. J. B. Williams, F.Z.S. was employed as a curator in the Biological Museum.

When the Royal Ontario Museum of Zoology was organized in October 1913, much of the insect material especially of the exhibition series was transferred from the Biological Museum. Later the entire collection was brought over. During the early years (1916-1917) of his connection with the Museum, Mr. E. B. S. Logier assisted in the care and arrangement of the insect material. From December 1, 1918 to June 30, 1926 Mr. N. K. Bigelow devoted most of his time to the collection. During seven summers in the field Mr. Bigelow added many thousands of specimens, largely Diptera and Coleoptera. At the expiration of Mr. Bigelow's appointment, supervision of the Museum's insect work was assumed by Dr. F. P. Ide. It was during the period (1928-1932) when Dr. Ide was in charge of the collection that it was transferred from its very cramped quarters in the original building to a larger room in the new east wing. The enlarged space made it possible at that time to take a good deal of material from storage and begin its ar-

rangement in the increased cabinet space provided. In 1933 Mr. C. E. Corfe was appointed to the first full time position in the Division of Insects. As a result of his labours the collection is becoming more and more useful for reference purposes. Although he still continues his active interest in the insect work of the Museum, Dr. Ide's duties in the Department of Biology made it necessary for him to give up direct charge of the collection. For two years before the author of this history took charge of the collection Dr. C. E. Atwood gave it oversight.

Although purchases have been made from time to time, the greater part of the collection has been donated by friends of the Museum or collected by persons connected with it. Neglecting numerous specimens donated from time to time, Miss Marsh may be noted as the first donor of an important collection in 1891. In 1896, Miss Stringer gave a collection taken in the Mackenzie River district. Mr. R. E. Coleman donated a number of specimens in 1910, followed by a collection donated by Mr. Paul Hahn in 1911.

After this date, the number of donations is too numerous to mention, there being at least 325, according to the records gleaned from old museum accession books. It is, however, necessary to mention briefly some of the larger donations, since they form the backbone of our present collection.

In 1914, Mr. Paul Hahn donated a fairly large collection of Lepidoptera, followed by a large collection of insects purchased from Mr. H. S. Saunders in 1915. In 1920 the collection of Dr. C. J. S. Bethune, consisting largely of Lepidoptera but with some Coleoptera, was purchased at a nominal price. The collection of Lepidoptera was augmented by the donation of a second collection by Mr. Paul Hahn and the purchase at a very moderate price of one from Mr. F. V. Rippon in 1928 and the donation of Dr. Ide's personal collection of 2,560 specimens, containing many microlepidoptera in 1931. In 1933, a collection of identified Coleoptera was donated by Mr. E. Oakley and one of some 1,200 Lepidoptera by Mr. H. V. Andrews. In this same year, the collection of the Provincial Museum, which had been housed in the Normal School, was transferred to the Royal Ontario Museum of Zoology. This collection consisted of about 25,000 specimens, collected by Dr. William Brodie, first provincial biologist, and 3,000 by Mr. C. W. Nash, Dr. Brodie's successor as provincial biologist.

In 1934, Mr. Corfe's collection of 5,500 Lepidoptera was purchased at a nominal price. In the same year Dr. C. E. Atwood donated a collection of 1,200 specimens. During 1935, a number of collections were received, of which the most important were 500 Noctuids and 2,000 Coleoptera, donated by the Entomological Society of Ontario through Mr. R. H. Ozburn, and 1,270 specimens collected by Mr. R. V. Whelan, a museum correspondent. In 1936 Mr. C. E. Hope donated 1,200 specimens, Dr. A. Cosens 430 and Mr. Warwick 523 specimens. During the present year (1937), Dr. Atwood donated 3,550 specimens and Dr. A. W. A. Brown 1,966.

We may now turn to a brief description of a few of the orders of insects in the collection.

The collection of Lepidoptera was first assembled by Dr. Ide in 1931, based on Dr. Bethune's collection, to which were added collections from Messrs. Morden, Russell, Evans, Hahn and Dr. Ide's personal collection. Since moving into the new quarters, this work has been admirably carried on by Mr. C. E. Corfe,

with additional specimens donated by Messrs. Whelan, Harper, Sternitzky, Dawson, Booth and Glazbrook. At present, the collection of Lepidoptera occupies fourteen cabinets, or 144 drawers, the number may be conservatively estimated at 38,000 specimens.

The collection of Coleoptera is due largely to the efforts of Mr. Bigelow. It has been enlarged by donations from Messrs. Hope, Oakley and Brodie. At present, the collection occupies 7 cabinets, with an estimated number of 41,750 specimens. Mention may be made here of a collection of beetles of economic importance which was exhibited in Paris in 1867, and which now attracts much attention from visitors who are interested in Coleoptera.

The collection of Diptera owes its present size and arrangement to the efforts of Mr. Bigelow. Since 1926, the collection has been greatly enlarged and it now occupies three and one-half cabinets, containing approximately 27,000 specimens.

The Orthoptera collection, which at present occupies two and one-half cabinets, containing about 8,000 specimens, is due largely to the activities of Professor E. M. Walker. This collection is being revised and enlarged at the present time.

The collection of Hemiptera occupies thirteen trays with an estimated content of some 6,500 specimens. A great deal of this material was received from the old Provincial Museum collection. At present, Mr. Corfe and myself have been engaged in arranging and incorporating the William Brodie material into our Hymenoptera collection. Although much of this material must remain unidentified at present, the value of the Brodie collection to the Hymenopterist has instigated this action.

The collection of Odonata has been greatly enlarged through the activities of Professor E. M. Walker, who has made an intensive study of this order. His collection occupies six cabinets of 124 drawers and in addition contains a considerable collection of exuvia. All of the species reported for Canada (more than 600) are represented in this collection.

The collections of Ephemeroptera, Trichoptera and Plecoptera are of particular importance to us, since aquatic biology is receiving so much attention in the Department of Biology, University of Toronto. This collection owes its present status to the efforts of Dr. Ide. Dr. W. E. Ricker and Miss Jean Fraser have also contributed to this collection.

The Museum has the nucleus of a collection of bird and mammal parasites. Museum field parties and graduate students in the Department of Biology are largely responsible for assembling this material. Those particularly active in this work have been L. L. Snyder, Dr. C. H. D. Clarke and Dr. D. A. MacLulich. Mr. R. V. Whelan has contributed quite a number of named and mounted specimens.

The collection of exotic specimens is rather an extensive one. The present collection of foreign Lepidoptera, amounting to over 5,000 species which was largely donated by Mr. Rippon, occupies much of our available space, owing to the presence of many large and beautiful specimens. Some of these are of rare occurrence and will no doubt prove of value to some future Lepidopterist. The collection of exotic Coleoptera occupies some twenty-two drawers, containing

over 15,000 specimens. In addition to this wealth of material, there is also an extensive collection of Lepidoptera mounted in glass and Riker mounts. This material will possibly be utilized for class work.

Recently the Division of Entomology received a very interesting and valuable collection of fossil insects. In 1934, Dr. T. L. Walker in a paper read at the fifteenth annual meeting of the Mineralogical Society of America mentioned the presence of insects in Cretaceous amber found at Cedar Lake in Manitoba. He referred to this discovery as follows: "In the course of the examination of specimens of amber with the microscope, it was observed that some of the specimens showed remains of insects, often fragmental, but at times perfectly preserved, even to the most delicate structures shown by the antennae and wings. There seems to be a great variety, not only of insects, but of spiders and other small forms. There is here an important fauna for the palaeontologist and entomologist to which, so far as the writer is aware, attention has not previously been directed." On reading this, Mr. F. M. Carpenter wrote to Professor Walker and obtained the material. He then enlisted the aid of J. W. Folsom, E. O. Essig, A. C. Kinsey, C. T. Brues, M. W. Boesel and H. E. Ewing and published a paper on their discoveries. Up to this date, the knowledge of the insect fauna of the Cretaceous period was almost negligible and this collection of fossil insects has added much to the knowledge of insect life of that time. This collection is now incorporated into our insect collection and will undoubtedly prove of much value to future workers.

THE BEES OF ALBERTA VII.

BY T. D. A. COCKEPELL,
Boulder, Colo.

Colletes eulophi albertensis n. subsp.

Female. Compared with one from Milwaukee, Wis., Sept. 27 (S. Graenicher), it differs thus: the coarsely punctured shining clypeus without a distinct median groove; tegulae very dark brown (instead of clear red); stigma and nervures black or almost so; third discoidal cell more produced at end; hair on anterior border of hind tarsi conspicuously yellowish; basal hair-band of second tergite very broad; the abdominal band clear white. Anterior wing 7 mm. long.

Alberta: Edmonton, July 14 (E. H. Strickland). This might be confused with *C. kincaidii* Ckll., from which it is at once known by the excessively fine punctures of the first two tergites. As in typical *C. eulophi* Robertson, the hair on thorax above is rather short and pale fulvous.

Colletes stricklandi n. sp.

Female. Length about 10 mm., anterior wing 7.2; black, including mandibles, antennae (flagellum very faintly reddish beneath) and legs; hair on head and thorax above, including tubercles, light yellowish fulvous (a little brighter than in the last species) of sides of face, cheeks and under side of thorax dull white; head broad, eyes strongly converging below; malar space fully twice as broad as long; labrum shining, with several pits; clypeus shining, very coarsely sculptured, the lower part striate, the middle with a sulcus; supraclypeal area prominent, with few punctures; third antennal joint a little longer than the fourth; mesothorax well punctured except on disc, which is smooth and shining;

prothoracic spine almost hidden by hair; scutellum shining anteriorly; base of metathorax with a very strong transverse keel, above which is the usual series of plicae, the intervals between them longer than broad; lower part of area polished, but posterior truncation coarsely sculptured and dull; tegulae very dark brown; wings hyaline, stigma dark reddish, well developed, extending into marginal cell (a character separating it from *C. cauponarius* Ckll.); nervures very dark brown; second cubital cell very broad, receiving recurrent nervure in middle; legs with dull white hair, faintly yellowish on inner side of hind tarsi; spurs red; front coxae not spined; abdomen shining, its hair yellowish white, nearly cream-colour, long and abundant on basal part of first tergite, forming dense entire bands of tomentum on margins of tergites 1 to 5 (weak in middle on first), but no band on base of second; first tergite strongly and conspicuously punctured, the punctures running more or less in rows; second with smaller, closer, punctures, third punctured like second; hind margins of tergites not red; hair bands of venter weak.

Alberta: Lethbridge, July 20, 1933 (E. H. Strickland). In Robertson's table of Illinois species this goes to *C. eulophi* Rob., from which it is readily known by the absence of a basal band on second tergite, the more coarsely punctured first tergite, and the much darker stigma. The abdominal punctures distinguish it from *C. kincaidii* Ckll., which is also a larger species (about 13 mm.)

Colletes armatus Patton. Bilby, Aug. 5 to 10, 1924, five males and three females (O. Bryant); Frank, Aug. 15, 1926, one female (Strickland). The female is known by the black hair on thorax above, and long spines on front coxae.

Colletes phacellae Cockerell. Females; Nordegg, three July 25, 1936 (Strickland); Oyen, Aug. 16 and 24, 1931 (O. Peck); Lethbridge, July 16 (Strickland); New Dayton, Aug. 13, 1925 (G. Allen Mail).

There are in addition smaller species, the females, from Beaverlodge, Edmonton, Lethbridge, Slave Lake, Oyen and Bilby, all looking much alike; but the males are evidently diverse, as follows (all without brownish or dark hairs on thorax above):

Malar space broader than long.....1.

Malar space longer than broad.....2.

1. Stigma red, nervures more slender; seventh ventral plate approximating type of *C. montanus* Morawitz (Lethbridge). Sp. A.
Stigma darker, nervures strong and very dark; wings of sagittae large and circular (Wahamun and Edmonton) Sp. B.
2. Wings not milky; first tergite broad and very short. (Nordegg) Sp. C.
Wings pale and appearing milky; first tergite longer 3.
3. First tergite conspicuously punctured, and with a red margin (Lethbridge). Sp. D.
First tergite not so punctured, and margin not red. (Bow Island). Sp. E.

I think that most of these, at any rate, are undescribed, but I must commend the matter to observers on the spot, who should get more and better material, and try to match the sexes.

The types of the new forms will be sent to the Canadian National Collection.

SYNONYMIC NOTES ON *AGLAIS MILBERTI* (GODART) WITH THE DESCRIPTION OF A NEW SUBSPECIES. (LEPIDOPTERA-NYMPHALIDAE).BY CYRIL F. DOS PASSOS,
Mendham, New Jersey.

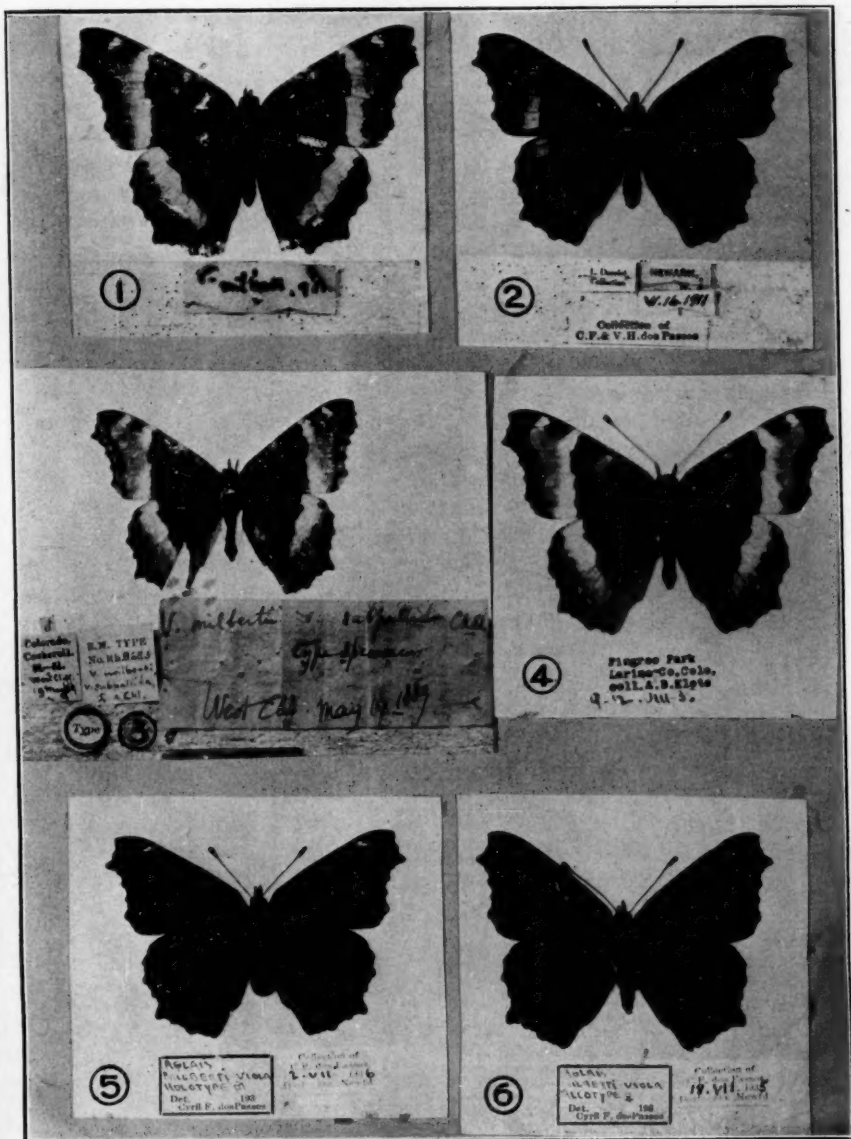
Vanessa milberti Godart was described (1819, Enc. Meth. 9: 307, No. 25) from a specimen sent to the Paris Museum by the French painter and naturalist, Milbert, who visited the United States on one or more occasions early in the nineteenth century. Last summer, while in Paris, the type was photographed through the kindness of Dr. Le Cerf and this is reproduced on Plate 4, fig. 1. Dr. Le Cerf informed the writer that the label was in the handwriting of P. H. Lucas who in 1860 re-labeled the collection, unfortunately destroying the original labels. This type is very badly worn so that today it might well pass for race *furcillata* Say for which reason the photograph of a typical specimen is also given (Plate 4, fig. 2). It has not been possible to ascertain the type locality with precision but it is known that Milbert collected in the neighborhood of Philadelphia, Pa. Walckenaer named a spider (*Sphodros milberti*) after him which was brought to Paris from this locality by Milbert (1837, Hist. Nat. Ins.-Apteres, 1: 249), so that place may be fixed as the type locality. Specimens from the Atlantic coast states from Maine to New Jersey agree with the type and the original description. Boisduval and Leconte (1833, Hist. Gen. Lep., Am. Sept., 187) also mention the Philadelphia locality for this butterfly.

Aglais milberti tr. f. *rothkei* Gunder (1927 Can. Ent. 59: 286 Pl. B, figs. 18 and 18b) from Scranton, Pa., the type of which is in the American Museum of Natural History, is an aberration acquired from a dealer and should be sunk as a synonym of *milberti*.

In 1825, Thomas Say, apparently without being aware of Godart's species, described *Vanessa furcillata* (Amer. Ent. 2, t 27). This name was placed in the synonymy by Doubleday & Hewitson (Gen. Diur. Lep. 1: 201) without comment and it seems to have remained there ever since. The type locality "North West Territory" and "the vicinity of Fort William, an establishment of the Hudson Bay Company" is sufficiently remote from the type locality of *milberti* to suggest a careful comparison of the two descriptions and Say's figure, since his type no longer exists. Such an examination reveals a distinct difference in the xanthine orange* submarginal band which shades to capucine buff,* the buff being wider and extending the entire length of the band on the basal side of both wings in *furcillata*. In *milberti*, it is narrower and broken opposite the cell on the primaries and disappears before reaching the anal angle on the secondaries. The name is certainly valid in a racial sense and a series of specimens in the collections of the American Museum and the writer, ranging from Alaska to Hudson Bay and south to New Mexico emphasize the distinction. Strange to say, the specimens in the writer's collection from the White Mountains, Arizona (D. K. Duncan) resemble the eastern species more closely.

In 1889, Dr. Cockerell described (Entom. 22: 85) *Vanessa milberti* var. *subpallida* from West Cliff, Custer Co., Colorado "characterised by the broad

color terms followed by an asterisk () refer to Ridgeway's Color Standard and Color Nomenclature, Washington, D. C. 1912.



1. *Aglais milberti* Godt. (type specimen); 2. *A. milberti* Godt. (typical); 3. *A. milberti* v. *subpallida* Ckll. (type); 4. *A. milberti* v. *subpallida* Ckll. (typical); 5. *A. milberti* v. *viola n.* var. (Holotype); 6. *A. milberti* v. *viola n.* var. (Allotype).

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reddish fulvous band on the upper side being, at its upper extremity and for a considerable area about its middle, of a pale yellowish colour." This character is present in Say's figure and appears constant in most specimens from the Rocky Mountain region and Pacific Coast States. Respecting this band, Say writes that it "is bifid at the costal margin, having the exterior division terminated by a white spot, and the inner division by a pale yellow one." He might have gone further, as his figure shows, as stated, that the pale yellow coloring extends along the entire black basal area of both wings and covers nearly one-half of the submarginal band. Consequently *subpallida* will fall to *furcillata*. The type of *subpallida* is in the British Museum (Natural History) No. 8683 and was also photographed last summer through the kindness of Mr. Riley. It is reproduced on Plate 4 (fig. 3) and a more perfect specimen from the same general locality is shown in fig. 4.

In a short article on the Butterflies of Southern Newfoundland (1935, Can. Ent. 67: 82, 88) the writer reported the capture of *milberti* at Doyles Station, Newfoundland. Subsequently, additional specimens were received from a local collector. These differ from typical *milberti* and *furcillata* in that the submarginal band of both wings on the upper side is not xanthine orange* shading to capucine buff*, but entirely mars orange*, approximately the color of the two spots in the discal cell of *milberti* and *furcillata* and this band has no light shading on the basal side except to a very slight extent on a couple of the female paratypes. To this race, which seems to occur throughout Newfoundland, the subspecies name *VIOLA* is given in honor of the writer's wife who has so generously assisted in his entomological studies. Both holotype and allotype are figured on Plate 4 (figs. 5, 6).

Holotype—♂, Doyles Station, Newfoundland July 2, 1936 (Hugh McIsaac) and *Allotype*—♀, same data, July 18, 1936, both in the American Museum of Natural History.

Paratypes—same data, 1 ♂ July 18, 1935, 1 ♂ July 29, 1936, 1 ♀ July 6, 1935, 1 ♀ July 16, 1935; 4 ♂ ♂ 3 ♀ ♀ Lewisport, Newfoundland, July-August 1905 (L. P. Gratacap) and 1 ♀ N. E. Belle Isle, Newfoundland, August 29, 1937 (Betty Jean Osborne). One pair each to the British Museum (Natural History) U. S. National Museum, Los Angeles Museum and Carnegie Museum. One ♂ and one ♀ in the Canadian National Collection, both taken at St. Johns, Newfoundland on August 1, 1935 (J. M. Swaine) are also designated paratypes. The remaining paratypes are in the collection of the author.

There are also eleven specimens in the author's collection from the type locality which are worn and appear to be hibernators. These show the characters of the new race but are not made part of the type series.

MACROSIPHUM APHIDS INFESTING ARTEMISIA.¹

BY GEORGE F. KNOWLTON AND MERLIN W. ALLEN,²

Logan, Utah.

More than fifty species of aphids are already known to attack the numerous kinds of *Artemisia* occurring in western North America. Some aphids and their ant attendants occur in great abundance, virtually blackening the affected

¹ Contribution from the Department of Entomology, Utah Agricultural Experiment Station.

² Associate entomologist and graduate assistant, respectively.

parts of the plants attacked. *Artemisia* is only one of many forage plant groups occurring in Utah which is damaged by aphids.

The following report is based upon a study of approximately 3,000 *Macrosiphum* specimens.³ Most of the material was collected in Utah and adjoining states by the senior writer during the years 1922 to 1937, inclusive. All measurements are given in millimeters.

There is some question whether all of the forms placed in the *Macrosiphum coweni-filifoliae-essigi* group should have full species rank. Various degrees of difference occur within this group, and an arbitrary line would have to be drawn between those considered as species, and those designated as subspecies or varieties. Because it seems possible to key the material at hand to its designated position, and because of the probability that further knowledge of all stages will add to the list of differences, the several forms in this group are here each considered as a species.

KEY TO SPECIES

- A. Rostrum tip slenderly obtuse *glabrum*
- AA. Rostrum acute
 - B. Cornicles without reticulations *longipes*
 - BB. Cornicles with reticulations.
 - C. Cornicles longer than antennal IV.
 - D. Unguis longer than cornicle in both alate and aptera.
 - E. Cauda 0.4 to 0.5 mm. in aptera; cornicles 0.55 to 0.7 .. *coweni*
 - EE. Cauda 0.21 to 0.32 in aptera; cornicles 0.4 to 0.52.
 - F. Antennal III of aptera with 1 to 3 sensoria; IV less than 0.4 mm. long *zerothermus* n. sp.
 - FF. Antennal III of aptera with 4 to 8 sensoria; IV more than 0.4 mm. long *essigi*
 - DD. Unguis not longer than cornicle in aptera.
 - E. Hairs on vertex blunt, not distinctly knobbed; antennal tubercles poorly developed *anomellus* n. sp.
 - EE. Hairs on vertex knobbed; antennal tubercles well developed.
 - F. Cornicles of aptera measuring 0.45 to 0.6 mm. long *cefsmithi* n. sp.
 - FF. Cornicles more than 0.6 mm. long *filifoliae*
 - CC. Cornicles not longer than antennal IV.
 - D. Sensoria on III of aptera more than 10; alate more than 20.
 - E. Unguis usually equal to or longer than antennal III; more than 1/3 of cornicle reticulated *ludovicanae*
 - EE. Unguis usually shorter than antennal III; 1/4 or less of cornicles reticulated *frigidae*
 - DD. Sensoria on III of aptera usually less than 10; on alates less than 20.
 - E. Unguis longer than 5 times base VI.
 - F. Cauda usually less than 0.3 mm. long *essigi*
 - FF. Cauda usually more than 0.3 mm. long *jonesii*

³ The writers are indebted to Professor M. A. Palmer and Dr. E. O. Essig for the loan of aphid material for comparisons.

EE. Unguis not longer than 5 times base VI.

F. Reticulations covering more than $1/4$ of cornicle length.

G. Cornicles 0.2 to 0.33 mm. long *frigidicola*

GG. Cornicles 0.45 to 0.6 mm. long *artemisivulgaris* n. sp.

FF. Reticulations covering less than $1/4$ cornicle length
..... *artemisiphilus* n. sp.

***Macrosiphum anomellus* n. sp.**

(Plate 5. Aptera 1-5)

Apterous vivipara: Body 1.43 to 1.96 mm. long; vertex aphis-like, with blunt to slightly pointed hairs; antennae 1.96 to 2.15 mm. long, dusky to dark beyond basal half of III; antennal III, 0.51 to 0.67 mm. long, with 2 to 5 sensoria; IV, 0.3 to 0.36; V, 0.26 to 0.34; VI, 0.12 to 0.13 + 0.37 to 0.45; rostrum attaining third coxae; rostral IV + V, 0.14 to 0.16 mm. long; hind tibiae 1.02 to 1.14; hind tarsi, 0.12 to 0.14; cornicles 0.43 to 0.49, dusky, with 3 to 5 hairs; cauda dusky, 0.3 to 0.34 mm. long.

Collections: Taken upon *Artemisia tridentata* at Little Cottonwood Canyon, Utah, April 24, 1937 (Knowlton); and Big Cottonwood Canyon, July 10, 1936 (Knowlton and C. F. Smith).

Taxonomy: This species runs to *Macrosiphum filifoliae* in Gillette and Palmer's key (Ann. Ent. Soc. Amer. 27: 169, 1934), from which it differs in shorter antennae, cauda, cornicles, and blunt to almost pointed instead of apically enlarged hairs on a rather *Aphis* like vertex. Differs from *Macrosiphum zerothermus* in longer cauda, longer body, and unguis shorter than cornicles. This species represents one of the apparent "connecting links" between the genera *Macrosiphum* and *Aphis*.

***Macrosiphum artemisiphilus* n. sp.**

(Plate 5. Aptera 11-15; alate 6-10)

Alate vivipara: Color green to blackish green; body 1.75 to 2.1 mm. long to base of cauda; antennae 2.67 to 3.3, black beyond basal portion of III; antennal III, 0.67 to 0.73 mm. long, with 4 to 8 sensoria; IV, 0.52 to 0.59; V, 0.49 to 0.54; VI, 0.14 to 0.16 + 0.57 to 0.7 mm; rostral IV + V, 0.15 to 0.16 mm. long; hind tibiae 1.47; hind tarsi 0.13 to 0.14; cornicles black, 0.4 to 0.43, with apical 0.06 reticulated; cauda dusky, 0.31 to 0.33 mm. long.

Apterous vivipara: Body 1.84 to 2.28 mm. long; antennae 2.57 to 3.46 mm. long, blackish beyond middle of III; antennal III, 0.63 to 0.76 mm. long, with 0 to 2 sensoria; IV, 0.45 to 0.53; V, 0.45 to 0.5; VI, 0.14 to 0.15 + 0.57 to 0.63; rostral IV + V, 0.16; hind tibiae 1.34 to 1.53; hind tarsi, 0.14; cornicles 0.47 to 0.53, blackish; cauda dusky, 0.34 to 0.39 mm. long.

Collections: On *Artemisia tridentata* at Cedar Creek (Box Elder County) June 9, 1930 (Knowlton); and Cedar Spring, May 19, 1930 (Knowlton), in Utah.

Taxonomy: *Macrosiphum artemisiphilus* keys to *M. frigidicola* in Gillette and Palmer's key (Ann. Ent. Soc. Amer. 27: 169, 1934) from which it differs in having longer cornicles with much less reticulated area; fewer sensoria on antennal III; and longer antennae and cauda. It differs from *M. coweni* in possessing shorter cornicles and cauda; cornicle approximately equal to IV in aptera, always shorter in alate; fewer sensoria on antennal III.

Macrosiphum artemisvulgaris n. sp.

(Plate 5. Apteræ 21-26)

Apterous vivipara: Color whitish green; body 1.8 to 2.35 mm. long; abdomen 1.1 wide; antennae 2.56, black beyond basal portion of III; antennal III, 0.66 to 0.83 mm. long, with 6 to 10 (average 8.4) sensoria; IV, 0.65 to 0.72; V, 0.54 to 0.62; VI, 0.17 to 0.22 + 0.88 to 0.93; rostrum reaching abdomen; rostral IV + V, 0.158 to 0.17; hind tibiae 1.73 to 1.92; hind tarsi 0.16 to 0.17; cornicles 0.46 to 0.58 mm. long with approximately the distal two-fifths definitely reticulated, color blackish beyond basal portion; cauda 0.37 to 0.45 mm. long, dusky; anal plate rounded.

Collections: Collected upon *Artemisia vulgaris* in Utah in Smithfield Canyon, August 24, 1925, at an elevation of 5500 feet (Knowlton); and Big Cottonwood Canyon, August 21, 1925 (Knowlton), the host in this case being identified as *Artemisia dracunculus*.

Taxonomy: This species runs to *Macrosiphum frigidicola* in Gillette and Palmer's key (Ann. Ent. Soc. Amer. 27: 169, 1934), from which it differs in more sensoria on antennal III, longer antennal segments and cornicles approximately twice as long. *Macrosiphum artemisvulgaris* is nearest to *M. ludoviciana*, from which it differs in shorter antennae; maximum measurements of antennal segments seldom reaching the minimum length shown by a large series of *lucoviciana*; and averaging fewer sensoria on antennal III.

Macrosiphum cefsmithi n. sp.

(Plate 5. Apteræ 16-20)

Apterous vivipara: Color shiny apple green to darker green and bluish green; body 1.6 to 1.78 mm. long; antennae 2.02 to 2.32 mm. long, blackish beyond approximately middle of III; antennal III, 0.57 to 0.69 mm. long, with 0 to 5 sensoria, usually 2 to 4; IV, 0.32 to 0.44; V, 0.36 to 0.47; VI, 0.12 to 0.15 + 0.38 to 0.59; rostral IV + V, 0.15 to 0.16 mm. long; hind tibiae 1.07 to 1.28; hind tarsi 0.13 to 0.16; cornicles 0.47 to 0.59, blackish, usually with 2 to 3 hairs; reticulations on distal end of cornicles 0.03 to 0.04 mm. covering one-tenth or less of cornicle; cauda dusky, 0.28 to 0.35 mm. long.

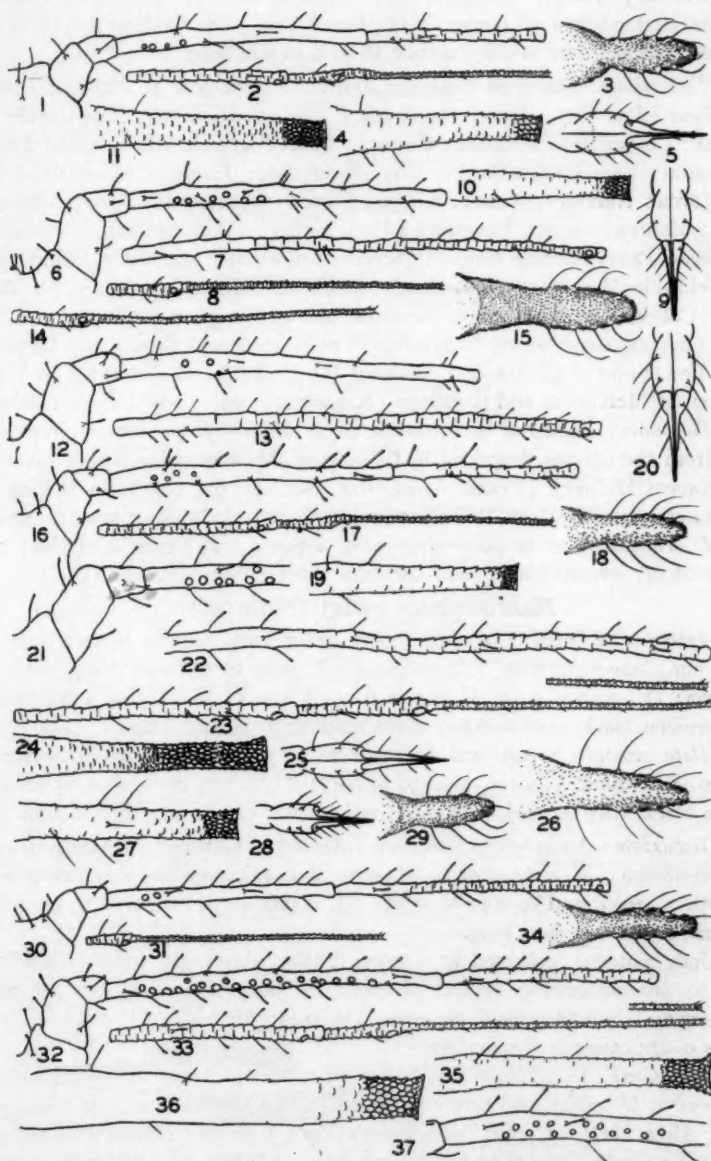
Described from material collected in Box Elder County, Utah, at Curlew, May 1, 1930 (Knowlton); Curley Valley, May 13, 1929 (Knowlton); Cedar Spring, Showell and Rattlesnake Pass, April 30, 1930 (Knowlton).

Taxonomy: Apteræ of *Macrosiphum cefsmithi* differ from *M. filifoliae* in being smaller in size, usually green in color, with antennal III being longer than either cornicles or unguis; averaging fewer sensoria on antennal III and possessing fewer hairs on cornicles.

Macrosiphum coweni (Hunter)

(Plate 5. Alate 32-35; aptera 36. Plate 6. Apteræ 1-5)

Alate vivipara: Color brown to greenish black; size 1.8 to 2.1 mm. long; antennae 2.91 to 3.22, black except base of III, antennal III, 0.67 to 0.84 mm., with 12 to 24 sensoria; IV, 0.49 to 0.61; V, 0.45 to 0.57; VI, 0.13 to 0.16 + 0.68 to 0.88 mm.; rostral IV + V, 0.14 to 0.16; cornicles blackish, 0.55 to 0.65, with 3 to 5 conspicuous hairs, and apical 0.08 to 0.1 mm. reticulated; cauda 0.29 to 0.36 mm. long.



Macrosiphum anomellus n. sp. Aptera 1-5. *M. artemisiphilus* n. sp. Alate 6-10; aptera 11-15. *M. cefsmithi* n. sp. Aptera 16-20. *M. artemisivulgaris* n. sp. Aptera 21-26. *M. zerothermus* n. sp. Aptera 27-31. *M. coweni* (Hunter). Alate 32-35; aptera 36. *M. ludoviciana* (Oest.). Base of antennal III, aptera 37.

Apterous vivipara: Size 1.74 to 2.35 mm. long; antennae 2.57 to 3.8, blackish beyond basal area of III; antennal III, 0.67 to 0.84, with 7 to 12 sensoria; IV, 0.43 to 0.57; V, 0.43 to 0.53; VI, 0.41 to 0.17 + 0.69 to 0.86 mm. long; rostrum reached 3d coxae; hind tibiae 1.4 to 1.68; hind tarsi 0.15 to 0.17; cornicles blackish, 0.61 to 0.8; cauda 0.38 to 0.46 mm. long.

Collections: Taken in Utah on *Artemisia tridentata* at Amalga, June 16, 1924; Bear River City; Beaver Dam; Big Cottonwood Canyon; Blue Creek; Cedar Creek; Circleville; Collinston; Corinne; Cove Fort; Daniels Canyon; Eureka; Farmington; Fish Lake; Garden City; Greendale; Hansel's Mountains; Hyde Park; Jordan Narrows; Kanab; Kelton; Kosmo; Laketown; Logan; Mammoth; Manila; Mantua; Ogden, Panguitch; Park Valley; Pilot Springs; Promontory; Rattlesnake Pass; Sardine Canyon; Scipio; Snowville; Stansbury Island; Trenton; Wellsville Mountains (Knowlton); and Zion National Park (A. M. Woodbury). Collected in Idaho upon the same host at Emigration Canyon and Mink Creek, June 28, 1925; Stone (Knowlton); at Blue Gulch, Burley and Castleford (D. E. Fox); and at Clifton and Rexburg (C. F. and C. K. Smith). In Wyoming, taken at McKinnon and Evanston (Knowlton); and Cody (W. L. Thomas).

Taxonomy: Material here considered as *Macrosiphum coweni* from Utah, varies from the species described by Wilson as *M. artemisiae* Boyer (*Nectarophora coweni* Hunter) (Trans. Amer. Ent. Soc. 41:97, 1915), in lacking sensoria on antennal IV, which Wilson states as "fourth with about seven." Differs from *M. artemisiphilus* in possessing more sensoria and longer cornicles; Alate vivipara of *M. artemisiphilus* have cornicles shorter than antennal IV.

***Macrosiphum essigi* (Soliman)**

Apterous vivipara: Color dark olive green with metallic luster; body 1.87 to 1.92 mm. long; antennae 2.7; antennal III, 0.64 to 0.7 mm. long, with 4 to 8 sensoria; IV, 0.43 to 0.51; V, 0.4 to 0.43; VI, 0.11 to 0.13 + 0.71 to 0.73 mm.; cornicles black, 0.48 to 0.54; cauda blackish, 0.33 mm. long.

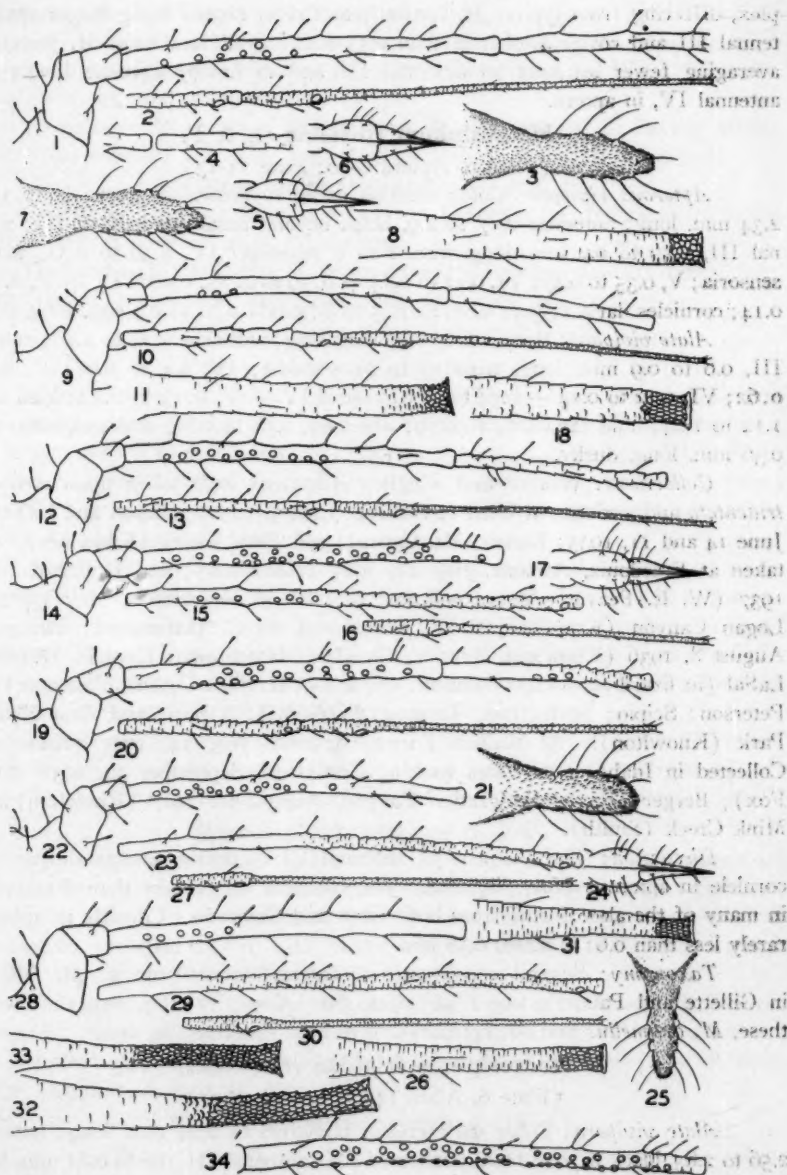
Alate vivipara.* Antennal III, 0.61 to 0.73, with 13 to 20 sensoria; IV, 0.43 to 0.48, without sensoria; V, 0.39 to 0.42; VI, 0.1 to 0.13 + 0.65 to 0.78; cornicles black, 0.41 to 0.49, with 0.065 reticulated; cauda 0.24 to 0.26 mm. long.

Discussion: An apterous specimen collected at Gardner, Montana, July 19, 1936 (Knowlton), is fairly close to *M. essigi*, but has antennae 2.5; antennal III, 0.55, with 3 sensoria; IV, 0.4; V, 0.39; VI, 0.126 + 0.74; cornicle 0.54, with 6 to 7 hairs; cauda 0.24 mm. long.

Utah material, collected at Curlew Valley, April 30, 1930 (Knowlton), is close to, but not entirely typical of *essigi*, the body being 1.67 mm.; antennae 2.3; antennal III, 0.55 with 6 sensoria; IV, 0.43; V, 0.39; VI, 0.12 + 0.62; cornicles 0.47; cauda 0.28 mm. long.

Collections: In addition to the above, material from *Artemisia vulgaris* which keys to *M. essigi*, and here considered as this species, has been collected in Utah at Alton, July 13, 1925; Blacksmith Fork Canyon; Hansel's Mountains; Newton; Snowville; and Trenton (Knowlton). Slides of California material secured from Dr. E. O. Essig, were taken on *Artemisia californica* at Santa Paula, April 27, 1911 (Essig); and Riverside, April 6, 1936 (A. E. Michelbacher).

*After Soliman, L. B. California University Pub. Ent. 4:98-100 (*Obtusicauda*) 1927.



Macrosiphum coreni (Hunter). Apterous 1-5. *M. filifoliae* G. & P. Apterous 6-10; alate 11-13/
M. frigidiae (Oest.). Alate 14-17; apterous 18-21. *M. jonesii* G. & P. Alate 22-27; apterous
 28-31. *M. ludoviciana* (Oest.). Apterous 32; alate 33-34.

Another collection on *Artemisia* was made at Pine Knot, California, August 17, 1937 (A. W. Levi).

Taxonomy: *Macrosiphum essigi* falls into the *Macrosiphum coweni* complex, differing from typical *M. coweni* material in unguis being longer than antennal III and cornicles shorter than 0.55 mm. It differs from *M. frigidæ* in averaging fewer sensoria on antennal III and in having cornicle longer than antennal IV, in aptera.

***Macrosiphum filifoliae* G. & P.**

(Plate 6. Apteræ 6-10; alate 11-13)

Apterous vivipara: Color blackish green to brownish green; body 1.5 to 2.34 mm. long; antennae 2.17 to 2.9, black beyond basal one-half of III; antennal III, 0.59 to 0.9 mm. long with 2 to 8 sensoria; IV, 0.38 to 0.51, without sensoria; V, 0.35 to 0.47; VI, 0.11 to 0.14 + 0.59 to 0.78; rostral IV + V, 0.12 to 0.14; cornicles dark, 0.59 to 0.85, hairs 5 to 8; cauda 0.29 to 0.4 mm. long, dusky.

Alate vivipara: Body 1.6 to 2.39 mm. long; antennae 2.24 to 2.86; antennal III, 0.6 to 0.9 mm. long, with 10 to 21 sensoria; IV, 0.4 to 0.61; V, 0.4 to 0.62; VI, 0.12 to 0.14 + 0.54 to 0.69; rostral IV + V, 0.12 to 0.14; hind tibiae 1.12 to 1.64; hind tarsi 0.14 to 0.19; cornicles, 0.58 to 0.84, dark; cauda 0.26 to 0.36 mm. long, dusky.

Collections: Winged and wingless specimens were taken upon *Artemisia tridentata* and varieties in Utah at Hardup, June 9, 1930; Johnson and LaVerkin, June 14 and 11, 1935; Kanab; Mt. Carmel; and Park Valley (Knowlton). Also taken at Freedonia, Arizona, July 11, 1925 (Knowlton); and Hollister, Idaho, 1937 (W. E. Peay). Apteræ collected in Utah at Beaverdam, May 17, 1937; Logan Canyon (Knowlton, C. F. Smith and F. C. Harmston); Paragonah, August 8, 1936 (Knowlton, Smith); Glendale; Hatchtown; Hooper, Hurricane, LaSal (in lizard stomach); Mantua; Orton; Orderville; Ogden; Pleasant View; Peterson; Scipio; Springdale; Trenton; Woodruff; Virgin; and Zion National Park (Knowlton). At Kaibab Forest, Arizona, July 14, 1925 (Knowlton). Collected in Idaho at 20 miles west of Castleford, September 30, 1932 (D. E. Fox); Berger (Fox); Emigration Canyon, August 16, 1927 (Knowlton); and Mink Creek (Smith).

Discussion: The filament of antennal VI is nearly always shorter than cornicle in apterous *Mac. filifoliae*. The filament was longer than the cornicle in many of the alate forms from both Utah and Colorado. Cornicle in aptera is rarely less than 0.6; in alates 0.58 mm.

Taxonomy: Several consistently different "forms" run to *M. filifoliae* in Gillette and Palmer's key (Ann. Ent. Soc. Amer. 27: 169, 1934). Two of these, *M. anomellus* and *M. cefsmithi*, have been described as new.

***Macrosiphum frigidæ* (Oestlund)**

(Plate 6. Alate 14-17; aptera 18-21)

Alate vivipara: Color dark green; body 1.8 to 2.24 mm. long; antennae 2.56 to 2.85, black beyond basal portion of III; antennal III, 0.6 to 0.82 mm. long, with 20 to 32 sensoria; IV, 0.45 to 0.67, with 0 to 10 sensoria; V, 0.41 to 0.48; VI, 0.15 + 0.51 to 0.64; rostral IV + V 0.15 to 0.6; cornicles black, 0.4 to 0.59; cauda dusky, 0.3 to 0.37 mm. long.

Apterous vivipara: Body 1.96 to 2.4 mm. long; antennal III, 0.6 to 0.73, with 14 to 26 sensoria; IV, 0.41 to 0.56, with 0 to 5 sensoria; V, 0.38 to 0.5; VI, 0.14 to 0.16 + 0.45 to 0.64; hind tibiae 1.36 to 1.6; hind tarsi 0.16 to 0.19; cornicles 0.43 to 0.56; cauda 0.38 to 0.43 mm. long.

Collections: On *Artemisia tridentata* at Blue Creek, Utah, May 19, 1930 (Knowlton); on *Artemisia frigida* at Estes Park, Nederland and Ward, Colorado, August 20 to 23, 1935 (Knowlton).

Taxonomy: *M. frigidiae* differs from *M. ludoviciana*e in having unguis shorter than antennal III; and one-fourth or less of cornicles reticulated.

Macrosiphum frigidicola G. & P.

Collections: Not yet taken in Utah. In Colorado on *Artemisia frigida* at Pingree Park, August 21, 1935 (Knowlton).

Taxonomy: Differs from *M. artemisiivulgaris* in being smaller, having fewer sensoria on antennal III, shorter antennal segments and cornicles.

Macrosiphum jonesii G. & P.

Plate 6. Alate 22-26; aptera 27-30)

Apterous vivipara: Color blackish green to black; body 1.84 to 2.22 mm. long; antennae, 2.5 to 2.93 mm. long, black beyond base of III; antennal III, 0.67 to 0.77 with 6 to 9 sensoria; IV, 0.47 to 0.53; V, 0.43 to 0.53; VI, 0.12 to 0.14 + 0.71 to 0.82; rostral IV + V, 0.14 to 0.16, nearly attaining third coxae; hind tibiae 1.27 to 1.57; hind tarsi, 0.16 to 0.18; cornicles, 0.43 to 0.5, black; cauda blackish, 0.33 to 0.41 mm. long.

Alate vivipara: Body 1.66 to 1.95 mm. long; antennal III with 14 to 19 sensoria; VI, 0.14 to 0.16 + 0.77 to 0.88 mm. long; other characters as in aptera.

Collections: On *Artemisia vulgaris* in Utah at Fielding October 22, 1929; and Ogden May 20, 1929 (Knowlton). On *A. tridentata* at Fish Lake, June 28, 1926; Logan Canyon October 6, 1927; Lost Creek, July 11, 1927; Meadowville, August 21, 1925; and Talyor June 3, 1935 (Knowlton).

Taxonomy: *M. jonesii* differs from *M. frigidicola*, *M. artemisiivulgaris* and *M. artemisiphilus* in having unguis longer than 5 times base of antennal VI. It differs from *M. essigi* in having cauda longer than 0.3 mm. in alate.

Macrosiphum longipes G. & P.

Apterous vivipara: Color green; body 2.55 to 2.97 mm. long; antennae 4.6 to 5.4, dusky beyond base of III; antennal III, 1.1 to 1.16 with 0 to 2 sensoria; IV, 1.19 to 1.33; V, 1.02; VI 0.2 + 1.25; hind tibiae, 2.65 to 3.17; hind tarsi 0.16 to 0.2; cornicles, 0.92 to 1.02, dusky without reticulations; cauda, 0.4 mm. long and not constricted in middle.

Collections: On *Artemisia tridentata* in Utah at Cottonwood Canyon, August 21, 1925 (Knowlton); Logan Canyon, August 28, 1932 (Knowlton). Also collected at Jackson, Wyoming, July 19, 1936 (Knowlton); and at State Bridge, Colorado, August 24, 1935 (Knowlton).

Macrosiphum ludovicianae (Oest.)

(Plate 5. Aptera 37. Plate 6. Aptera 32; alate 33-34)

Alate vivipara: Color green with grayish pulverulence; body 2.3 to 2.8 mm. long; antennae 4.02 to 4.3 mm. long, black beyond base of III; antennal III, 0.93 to 0.98, with 43 to 56 sensoria; IV, 0.83 to 0.88; V, 0.71 to 0.82; VI,

0.22 to 0.28 + 1.03 to 1.09; rostral IV + V, 0.16 to 0.18; hind tibiae, 2 to 2.4; hind tarsi 0.16 to 0.17; cornicles 0.46 to 0.6, blackish; cauda 0.39 to 0.43 mm. long, dusky.

Apterous vivipara: Color grayish white overlying green to yellowish-green: body 2.15 to 2.81 mm. long; antennae 3.83 to 4.37; antennal III, 0.84 to 0.98, with 10 to 19 sensoria; IV, 0.76 to 0.99; V, 0.66 to 0.77; VI, 0.24 to 0.31 + 1.1 to 1.14; cornicles blackish beyond dusky basal portion, 0.55 to 0.8; cauda 0.46 to 0.54 mm. long, dusky.

Discussion: As a rule the unguis is longer than antennal III. The unguis of some winged and wingless specimens, collected at Ogden and Blacksmith Fork Canyon, Utah, during May and June of 1930 (Knowlton), were shorter than III. As these were sometimes collected in colonies with specimens in which the unguis was longer than III, and as there is a considerable amount of variation in the length of both structures, the writers considered these specimens are merely less typical forms of *M. ludoviciana* (Oest.). One less typical apterous specimen, collected at Ogden, May 20, 1930 (Knowlton), had 19 and 20 sensoria on its antennae, and had unusually short antennals V, which were 0.52 and 0.55 mm. long, respectively. Another wingless specimen, collected at Salt Lake City on June 20, 1925 (Knowlton), had 22 and 25 sensoria, respectively, but antennal V was normally long. Most specimens collected had from 10 to 13 sensoria; however, one specimen from City Creek Canyon had 7 on one antenna and 11 on the other. Specimens collected at Afton and Smoot, Wyoming, July 19, 1936 (Knowlton), had antennal III, 1.02 to 1.07 mm. long and unguis 1.03 to 1.11 mm.

Collections: Collected in Utah upon *Artemisia vulgaris* and varieties at Avon, August 5, 1937; Bellmont; Big Cottonwood Canyon, August 21, 1925; Centerville; City Creek Canyon; Collinston; Farnlington; Fielding, Granite; Huntsville, Hyrum; Logan Canyon; Mill Creek Canyon; Riverheights; Zion National Park, July 10, 1925 (Knowlton); and Brigham City (Knowlton, C. F. Smith).

Collected in Idaho at Dayton, August 1936, (Knowlton); Buhl (D. E. Fox); and Franklin (Smith).

Apterous ovipara: Color pale green to yellowish green; body 2.25 to 2.68 mm. long; antennae 2.95 to 3.2, dark beyond base of III; antennal III, 0.75 to 0.8 with 12 to 16 sensoria on basal half; IV, 0.63 to 0.67; V, 0.53 to 0.57; VI, 0.18 to 0.2 + 0.71 to 0.79; rostral IV + V, 0.14 attaining third coxae; hind tibiae, 1.68 to 1.88, sensoria on proximal half; cornicles 0.43 to 0.45, dusky; cauda 0.3 to 0.33 mm. long, dusky

Collections: Collected in Utah at Bellmont, Collinston, and Fielding, October 22, 1929 (Knowlton); and Salt Lake City, October 25, 1929 (Knowlton).

Alate male: Color pale green; body 0.92 to 1.43 mm. long; antennae, 2.45 to 3.28, dark; antennal III, 0.59 to 0.79 with approximately 60 sensoria scattered over entire length; IV, 0.53 to 0.66 with 30 sensoria; V, 0.43 to 0.59 with 17 sensoria; VI, 0.16 to 0.22 + 0.61 to 0.92; rostral IV + V, 0.12; hind tibiae 1.08 to 1.57; cornicles, 0.18, pale; cauda, 0.18 mm. long, pale.

Collections: In Utah at Collinston and Fielding, October 22, 1929 (Knowlton).

Macrosiphum zerothermus n. sp.

(Plate 5. Apteræ 27-31)

Apterous vivipara: Body 1.23 to 1.4 mm. long and pear-shaped; width 0.75 to 0.87 across abdomen; vertex aphid like, antennal tubercles being poorly developed; antennae 1.84 to 2.26 long, black beyond distal fifth of III; antennal III, 0.49 to 0.58, with 1 to 3 sensoria on basal third; IV, 0.25 to 0.35; V, 0.24 to 0.35; VI, 0.09 to 0.12 + 0.51 to 0.66; rostrum reaching third coxae; rostral IV + V needlelike at tip, 0.126 to 0.14; hind tibiae 0.9 to 1.; hind tarsi 0.13 to 0.16; cornicles 0.4 to 0.5, black, with 5 to 8 hairs; cauda blackish, 0.21 to 0.26 mm. long.

Collections: Taken upon *Artemisia tridentata* at Kelton and Cedar Creek, Utah, August 25, 1932 (Knowlton).

Taxonomy: This material runs to *Macrosiphum coweni* in Gillette and Palmer's key (Ann. Ent. Soc. Amer. 27:169, 1934), from which it differs in fewer sensoria on antennal III, shorter antennal cornicles, cauda, and blunt instead of apically enlarged hairs on rather *Aphis* like vertex. Differs from *M. essigi* in more hairs on cornicles, fewer sensoria, shorter antennals IV and V, and longer rostrum.

ON THE NUMBER OF MOLTS IN LARVAE OF THE FALL WEB-WORM, HYPHANTRIA CUNEA DRURY. (LEP. ARCTIIDAE).

BY RALPH B. SWAIN,

Department of Biology, University of Colorado, Boulder, Colorado.

In the mass of literature dealing with the fall webworm there are few references to the number of larval stadia. Bruner (1) states that there are four or five molts in eastern Nebraska. Dyar (2), who made measurements of the head capsules, found seven stadia. Snodgrass (3) found six larval stadia. He figures the first, second, fifth, and sixth instars.

At Fort Collins, Colorado, (altitude 5,100 ft.), in the summer of 1935, an attempt was made to determine the exact number of larval stadia by rearing webworms from eggs to pupae in individual cages.

Two lots of ten larvae each, one hatched from a single egg mass July 7, the other hatched from a single egg mass July 20, were used in this experiment. Each larva was placed on a section of fresh apple leaf in a cotton-stoppered shell vial measuring $8\frac{1}{2}$ by $2\frac{1}{4}$ centimeters. A layer of moistened sand covered with blotting paper was in the bottom of each vial. Fresh foliage was supplied each day to the early instars. Later the nearly mature larvae were transferred to glass tumbler cages covered with cloth and half-filled with moist sand. Cages were kept in a shaded "natural temperature" house.

The greatest width of the head capsule was determined with a binocular microscope equipped with a micrometer eyepiece. Molted head capsules were preserved and measured as checks. Natural conditions, of course, cannot even be approximated when normally gregarious caterpillars are reared in individual cages. However, by using this method of rearing, the risk of losing head capsules was avoided.

Half of the twenty larvae reared as described above passed through eight larval stadia. Five larvae passed through nine stadia, two through ten, and one through eleven. Two others died as immature larvae, one in the seventh and one

in the eighth stadium. Table I presents the head width averages for the ten eight-stadia larvae. Dyar's measurements are given for comparison.

TABLE I.

Stadium	WIDTH OF HEAD CAPSULE Averages for ten eight-stadia larvae.		Dyar's values (computed)
	By measurement	By computation	
I	0.35 mm.	0.33 mm.	0.3 mm.
II	0.47 "	0.45 "	0.4 "
III	0.67 "	0.61 "	0.6 "
IV	0.94 "	0.82 "	0.8 "
V	1.34 "	1.11 "	1.2 "
VI	1.80 "	1.50 "	1.7 "
VII	2.32 "	2.03 "	2.4 "
VIII	2.75 "	2.75 "	

From time to time larvae recently collected in the field were measured in order to have figures to compare with those obtained in the insectary. Table II, which presents these measurements, shows that the values readily fall into five distinct groups and that each group of measurements may be identified as to stadium by comparison with the measurements of Table I. Webworms in the final stadium are easily recognized by the reddish brown color of the hairs. This color does not appear, to the writer's knowledge, until the larvae have molted for the last time before the prepupal stage. Thus the figures in the column farthest to the right in the table below were known to be head measurements of last stadium larvae.

TABLE II.

Probable stadium	WIDTH OF HEAD CAPSULE Head widths of 31 larvae collected in the field at various times during the 1935 season.				
	IV	V	VI	VII	VIII
	0.84 mm.	1.08 mm.	1.41 mm.	2.28 mm.	2.82 mm.
	0.87 "	1.11 "	1.53 "	2.16 "	2.88 "
	0.78 "	1.26 "	1.44 "	2.19 "	2.88 "
	0.78 "	1.03 "	1.50 "	2.22 "	2.76 "
	0.84 "	1.02 "	1.50 "	2.22 "	2.76 "
		1.08 "	1.56 "	2.16 "	2.70 "
					2.82 "
					2.70 "
Calculated widths from Table I.	0.82 "	1.11 "	1.50 "	2.03 "	2.75 "

The head widths of the ten aberrant larvae, the nine to eleven-stadia individuals, will not be presented. Eleven stadia is an unusually large number for even an arctian and since all the twenty individually caged larvae were reared under the same conditions, an explanation for the wide variation in number of stadia is not apparent. Insect parasitism could not have been a factor; disease probably was not. It seems more likely that either the number of stadia normally varies or that these larvae were particularly sensitive to the abnormal conditions under which they were reared.

If the fact that none of the reared larvae passed through less than eight stadia, (one died immature in the seventh stadium), is considered indicative, and the figures of Table II are considered representative, it may be concluded that in the Ft. Collins area, the fall webworm passes through a minimum of eight larval stadia.

From a thesis presented in partial fulfillment of the requirements for the Master's degree at the Colorado State College, Ft. Collins, Colorado.

LITERATURE CITED

1. Bruner, L. 1893. [Extract from Ann. Rpt. Nebr.] State Hort. Soc., pp. 168-173, figs. 5.
2. Dyar, H. G. 1890. *Psyche*, 5: 175-176.
3. Snodgrass, R. E. 1922. Smithsonian Inst. Rpt. for 1921, pp. 395-414, pls. 2, figs. 11.

A NEW CLEORID FROM SOUTHEASTERN CALIFORNIA
(GEOMETRIDAE)*.

BY J. MCDUNNOUGH,

Ottawa, Ont.

Pterotaea sperryae n. sp.

Differs from the typical section of the genus in the presence of a small fovea at the base of the male forewings (as in *agrestaria* Grossb.) and the lack of a hair-pencil on the hind tibiae in the same sex. Placed in this genus on account of the similarity of male genitalia, which are very close to those of *serrataria* B. & McD. as figured in my Studies in North American Cleorini.

Male. Palpi short, scarcely exceeding front, clothed with an admixture of blackish and white scaling and with second joint fringed below with short hairs. Antennae strongly bipectinate. Front strongly bulging, clothed with closely appressed, mixed black and white scales. Thorax and abdomen smoothly clothed with an admixture of black and white scales and thorax with an evident posterior, divided tuft. Primaries rather broad and pointed, deep blackish-gray, sprinkled evenly with whitish scaling. An obscure inwardly oblique dark shade near base of wing; t. a. line black, angled outwardly below costa, then inwardly oblique and subparallel to outer margin, preceded by a faint dark shade-line; t. p. line obscure below costa, then distinct, black, and subparallel to outer margin, rather rigidly oblique, followed by a narrow pale band which, in its turn, is bordered by a diffuse darkish shade; traces of a dark median shade-band, most distinct in inner half of wing. S. t. line indistinct, whitish, somewhat irregularly scalloped and preceded by a broad smoky shade. A black terminal line. Fringes smoky with pale basal line. Secondaries with outer margin slightly scalloped; paler in color than primaries, with dark median line parallel to outer margin, not attaining costa; an indistinct narrow dark band half-way between this line and base of wing and a similar subterminal band, most evident near anal angle. Dark terminal line. Beneath evenly whitish, heavily sprinkled with smoky.

Female. Antennae very slightly serrate. Considerably blacker than the male on both wings and with secondaries more decidedly scalloped. Maculation often quite obscure. Expanse 30-33 mm.

Holotype—♂, Morongo Valley, S. Calif., May 11, 1937, (G. and J. Sperry); No. 4374 in the Canadian National Collection, Ottawa.

Allotype—♀, same data, in Canadian National Collection.

Paratypes—8♂, 17♀, same data, May 10-12; 3♂, 5♀, in Canadian National Collection, the balance returned to the Sperry Collection.

I take much pleasure in naming this species after Mrs. Grace Sperry, who, with her husband, has in recent years furnished so much interesting material for study from the arid regions of Southeastern California.

*Contribution from the Division of Entomology, (Systematic Entomology), Department of Agriculture, Ottawa.

THE ARMY WORM OUTBREAK IN NOVA SCOTIA IN 1937.

BY A. D. PICKETT,

Provincial Entomologist for Nova Scotia.

During the last few days of July and the first half of August 1937 there occurred what probably has been the worst outbreak of the army worm, *Cirphis unipuncta* Haw. in this province. The damage was widespread and in many cases severe.

The first report of damage was received on July 25th and on July 26th outbreaks at Gaspereaux, Avonport and Woodside, all in Kings County were investigated. On the same day reports of heavy outbreaks were received from Annapolis and Antigonish Counties. Within ten days reports were received of outbreaks in all the counties, Victoria being the last to report on August 7th. With the exception of Antigonish, reports were earlier from the western and southern counties than from the northern and eastern counties. Outbreaks were reported in different counties as follows: *Annapolis*:—Clarence, Brooklyn, Wilmot, Bridgetown and Melvern Square. *Antigonish*:—Every district in the county, New France being particularly heavy. *Cape Breton*:—Coxheath, Sydney River, Meadows, Portage, Salmon River, Mira and Little Lorraine. *Colchester*:—Great Village, Onslow, Lower Truro. *Cumberland*:—West Brook. *Guysborough*:—Guysborough, Manchester. *Hants*:—The Gores, Rawdon, Falmouth, Brooklyn, Ardoise, Martock. *Kings*:—Gaspereau, Avonport, Woodside, Blomidon, Welsford, Morristown, Lakeville, Woodville, Port Williams, Shief field Mills, Grand Pre. *Lunenburg*:—New Germany, Lunenburg and other parts of the county. *Pictou*:—Scotsburn, Bailey's Brook, River John, Union Centre, Caribou Island, Three Brooks. *Victoria*:—South Cove, Bay St. Lawrence, Cape North. *Yarmouth*:—Vicinity of the town of Yarmouth.

All other counties reported infestations, but no specific places were mentioned. Also it should not be construed that the above mentioned places constitute all the infested areas in the counties in which they are situated. These were places especially mentioned by Agricultural Representatives in their reports.

The caterpillars attacked grains in particular; wheat, barley and oats appearing attractive to them in the order named. In some cases wheat fields were heavily attacked, while oats and barley in the same field were damaged little or not at all. Corn, especially sweet corn, was badly injured when the insects encountered it in their migrations. Turnips and mangolds were slightly injured in some cases, but potatoes did not appear attractive to them.

A report by R. P. Gorham on the outbreak in New Brunswick has been noted in the "Maritime Farmer" to the effect that the clover in the newly seeded grain fields was not destroyed. This does not apply to conditions in Nova Scotia since the clover was badly damaged in some fields along with the timothy.

In some cases the insects attacked lawns and completely destroyed the grass, eating it off to the ground level. As the weather was dry at the time, this left the lawns in a serious condition and they failed to recover during the remainder of the season. In many sod orchards the grass was completely destroyed. In some orchards the only vegetation left green would be a few cadlock plants and a few other weeds.

On August 2nd a pupa was taken at Port Williams, Kings County, and by August 5th they were plentiful. By August 9th all had entered the pupa stage in that district. The latest outbreak reported was at West Brook, Cumberland County on August 13th, and this field was treated on August 15th.

The poisoned bran baits gave good control where they were properly used. In some fields the caterpillars were so numerous that the recommended quantity of 25 pounds of bait per acre was not sufficient and satisfactory kills were not obtained, especially where arsenate of lead and arsenate of lime were used. These poisons, however, gave satisfactory control when sufficient bait was applied, but they were considerably slower in effecting a kill than Paris green or sodium arsenite.

POSSIBLE EXPLANATION OF THE CAUSE OF THE OUTBREAK

It is interesting to speculate on the cause of the outbreak in this province and as to how it developed. The only other outbreaks in the province of which we have records occurred in 1914 and in 1920. These outbreaks were very severe in a number of sections but they were not so widespread as during 1937.

In 1936 a small area in Yarmouth County, not far from the town of Yarmouth was heavily infested. In the Spring of 1937 numerous adults were taken in a light trap at Round Hill, Annapolis County by Mr. F. C. Gilliatt of the Annapolis Royal Laboratory.

It has been suggested that the larvae do not ordinarily live through the winter in this province due to the low temperatures or from some other cause. If this is true it may be that whereas the last two winters have been comparatively mild in this province, the insect may have established itself in Yarmouth County from moths flying in from the south during the fall of 1935 or the spring of 1936, more likely the former. At any rate, the insects were numerous enough to do some damage during the summer of 1936. From Yarmouth County the insects may have spread in easterly and northerly directions initiating infestations in the other counties of Nova Scotia, New Brunswick and Prince Edward Island that autumn. Since the winter of 1936-37 was comparatively mild the insects may have survived and with favourable conditions, and an apparent absence of parasites, developed in outbreak numbers in 1937.

There appeared to be a fairly heavy emergence of moths in August, but it is not known how the fall generation has developed; however, caterpillars could not be found later in the fall near points where heavy infestations occurred in July and August.

NEWS AND VIEWS

RETIREMENT OF MR. H. F. HUDSON.

Horace Frederick Hudson, B. S. A., Assistant Entomologist, in charge of the Dominion Entomological Branch laboratory at Strathroy, Ontario, for twenty-five years, retired on superannuation on January 1, 1938.

Mr. Hudson was born at Devizes, Essex, England, and came to Canada in 1903. Completing his studies at the Ontario Agricultural College in agriculture, he graduated in 1907. From 1909 to 1912 he was an inspector of nurseries and nursery stock under the State Entomologist at the Illinois Agricultural Experi-

ment Station, Urbana, Illinois. He resigned from this position in May, 1912, to take an appointment with the Dominion Department of Agriculture as a field officer in the Entomological Branch. In 1913 he was placed in charge of the newly established laboratory at Strathroy, Ontario. In November, 1914, Mr. Hudson enlisted in the 16th Battery, Canadian Field Artillery of the Canadian Expeditionary Force. After a considerable period of active service he was severely wounded on February 14, 1916, at Hill 60.

After a lengthy period of hospitalization and his discharge in May, 1917, Mr. Hudson gradually took up the threads of his entomological work at Strathroy and again assumed full charge of the work at that laboratory. On July 1, 1937, he requested that he be relieved of his official duties on account of ill health, and made definite application for retirement from the service. His request was acceded to with great regret by the Department. After six months' retirement leave his official connection with the Entomological Branch was terminated on January 1, 1938.

Mr. Hudson's activities have been many and varied. His twenty-six scientific papers cover a considerable range in the field of economic entomology. While much of his interests and time were largely involved in making entomological information directly available to farmers, the preparation of museum exhibit material was an important feature of the work at his laboratory.

The relation of Mr. Hudson to his colleagues was one of warm friendship, cheer, encouragement and perennial willingness to co-operate in the exchange of information, material and assistance. In his retirement he is assured of the continued interest of all his personal and professional friends and colleagues in Canada and the United States.

The Division of Entomology of the Dominion of Canada, Department of Agriculture has just issued a stencilled index of federal entomological publications. The index has been prepared by Mr. C. E. Petch, Entomologist in charge of our Hemmingford, P. Q. Entomological Laboratory.

This index is a very acceptable contribution and should be of great value to workers not only in Canada but elsewhere as well.

A.G.

Mailed Saturday, May 14th, 1938.

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